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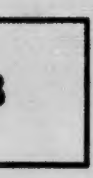

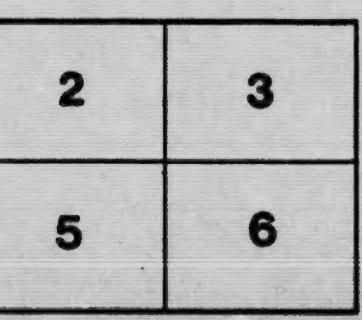

# UNIVERSITY OF TORONTO STUDIES

## PAPERS FROM THE PHYSICAL LABORATORIES

## No. 52: ON THE ULTRA-VIOLET SPECTRUM OF ELEMENTARY SILICON, by Professor J. C. McLennan and Evan Edwards

(Reprinted from the Transactions of the Royal Society of Canada, Series III, V. I. 9)

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# *On the Ultraviolet Spectrum of Elementary Silicon.*

By PROFESSOR J. C. MCLENNAN, F.R.S. and MR. EVAN EDWARDS,
M.A., University of Toronto.

(Read May Meeting, 1915).

In the course of some work by the writers with a fluorite spectrograph on the ultraviolet spectrum of mercury, cadmium and zinc their attention was drawn to a paper recently published by Sir William Crookes[1] on "The Spectrum of Elementary Silicon." In this paper the wave-lengths in the spark spectrum of this element are given down to $\lambda$ = 2,124·63 A.°U. As the only wave-length as yet published for this element, shorter than this limiting one, is one recorded by Eder and Valenta[2] at $\lambda$ = 1,929·0 A.°U. it was thought that it might be well to examine the spectrum in the region below $\lambda$ = 2,125 A.°U. This has now been done and the present paper contains a list of the lines which have been observed down to $\lambda$ = 1,842·2 A.°U.

Sir William Crookes in his paper records that the elementary silicon of the highest purity which he was able to obtain was supplied to him by the Carborundum Company at Niagara Falls. He also records that the three samples supplied by them to him gave on analysis 99·56, 99·86 and 99·98 per cent. of silicon the impurities being titanium, iron and aluminium.

On account of these samples being so pure the writers applied to the manager of the above-mentioned company for a few small pieces and these were sent to us with the accompanying statement that they were presumably of as high purity as those with which the observations of Sir William Crookes were made.

Our experiments were made with these pieces of silicon and we desire here to acknowledge our indebtedness to the Carborundum Company for their kindness in the matter.

In making the experiments the spark was obtained from the discharge of two one gallon Leyden jars charged with a 10 inch induction coil. A great many plates were taken with different pieces of the silicon and seven of the best of these were carefully measured up to arrive at the wave-lengths of the different lines which came out.

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[1] Sir William Crookes. Proc. Roy. Soc. No. A. 621. Vol. 90. Aug., 1914, p. 512.

[2] Eder and Valenta Atlas Typischer Spectren, Wien, 1911.

In taking the photographs the spark spectrum of zinc was first taken on the plate, then the spark spectrum of silicon and finally the spark spectrum of aluminium.

The prominent zinc and aluminium lines in the region examined were:

| Zinc lines[1] | Aluminium lines[2] |
|---|---|
| λ = 2,138·66 A.°U. | λ = 1,990·57 A.°U. |
| 02·35 " | 35·9 " |
| 00·06 " | 31·15 " |
| 2,064·32 " | 1,862·81 " |
| 62·08 " | 58·2 " |
| 25·51 " | 54·8 " |

and these were used as standards when determining the wave-lengths of the silicon lines. In measuring up a plate the distances of the various zinc, silicon, and aluminium lines from the edge of the plate were carefully measured with a Hilger comparator. The distances of the above-mentioned zinc and aluminium lines, from the edge of the plate were used for the abscissae of a calibration curve and the wave-lengths of the lines as ordinates. This calibration curve was then used to determine the wave-lengths of the silicon lines. Photographs were also taken of the spark spectra of iron and aluminium to make certain that no lines of these elements were included in those obtained with the samples of silicon but as we had no samples of titanium at hand we were not able to take the precaution of making absolutely certain that no lines of that element were included in those ascribed to silicon. However, the high purity of the silicon used, and the fact that the same spectrum came out on the plates when different pieces of the metal and different points on the same pieces were used as sparking terminals would seem to guarantee the purity of the spectrum observed.

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[1] Eder and Valenta Atlas Typischer Spectren, Wien.

[2] Handke. Inaugural-Dissertation. Berlin, 1909, p. 18.

The mean values of the measurements made on the wave-lengths of all the lines observed in the spark spectrum of silicon are:

| Wave-lengths in Ångström Units. | Relative Intensity. Arbitrary scale. |
|---|---|
| λ = 2,124·4 | 10 |
| 2,073·1 | 2 |
| 65·2 | 1 |
| 61·4 | 2 |
| 54·9 | 2 |
| 24·9 | 1 |
| 1,990·1 | 4 |
| 86·2 | 1 |
| [illegible]·7 | 1 |
| 09·3 | 1 |
| 01·0 | 5 |
| 1,885·5 | 10 |
| 58·4 | Faint |
| 53·9 | 1 |
| 50·0 | Faint |
| 45·5 | 2 |
| 42·2 | 1 |

The Physical Laboratory,
University of Toronto.
May 1st, 1915.